4.11 Noise

This section analyzes the temporary and long-term noise impacts associated with the construction and operation of campus development from implementation of the proposed 2021 LDRP.

4.11.1 Environmental Setting

Overview of Sound Measurement

Sound is a vibratory disturbance created by a moving or vibrating source, which is capable of being detected by the hearing organs. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired and may therefore be classified as a more specific group of sounds. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and, in the extreme, hearing impairment (Caltrans 2013).

Noise levels are commonly measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound pressure levels so that they are consistent with the human hearing response. Decibels are measured on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used to measure earthquake magnitudes. A doubling of the energy of a noise source, such as doubling of traffic volume, would increase the noise level by 3 dBA; reducing the energy in half would result in a 3 dBA decrease (Crocker 2007). Because the dB scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. For example, if two noise sources produce identical noise levels of 50 dBA, their combined sound level would be 53 dBA, not 100 dBA. However, where ambient noise levels are high in comparison to a new noise source, there will be a small change in noise levels. For example, when an ambient noise level of 70 dBA is combined with a noise source generating 60 dBA, the resulting noise level equals 70.4 dBA.

Human perception of noise has no simple correlation with sound energy: the perception of sound is not linear in terms of dBA or in terms of sound energy. Two sources do not “sound twice as loud” as one source. It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA, increase or decrease (i.e., twice the sound energy), that a change of 5 dBA is readily perceptible (8 times the sound energy), and that an increase (or decrease) of 10 dBA sounds twice (half) as loud (10.5 times the sound energy) (Crocker 2007).

Sound changes in both level and frequency spectrum as it travels from the source to the receiver. The most obvious change is the decrease in level as the distance from the source increases. The manner in which noise reduces with distance depends on factors such as the type of sources (e.g., point or line, the path the sound will travel, site conditions, and obstructions). Noise levels from a point source typically attenuate, or drop off, at a rate of 6 dBA per doubling of distance (e.g., construction, industrial machinery, ventilation units). Noise from a line source (e.g., roadway, pipeline, railroad) typically attenuates at about 3 dBA per doubling of distance (Caltrans 2013). The propagation of noise is also affected by the intervening ground, known as ground absorption. A hard site, such as a parking lot or smooth body of water, receives no additional ground attenuation and the changes in noise levels with distance (drop-off rate) result from simply the geometric spreading of the source. An additional ground attenuation value of 1.5 dBA per doubling of distance applies to a soft site (e.g., soft dirt, grass, or scattered bushes and trees) (Caltrans 2013). Noise levels may also be reduced by intervening structures. The amount of attenuation provided by this “shielding” depends on the size of the object and the frequencies of the noise levels. Natural terrain features such as hills and dense woods, and man-made features such as buildings and walls, can significantly alter noise levels. Generally, any large structure blocking the line of sight will provide at least a 5-dBA reduction in source noise levels at the receiver (Federal Highway Administration [FHWA] 2011). Structures can substantially reduce exposure to noise as well. The FHWA's guidelines indicate that modern building construction generally provides an exterior-to-interior noise level reduction of 20 to 35 dBA with closed windows.

The impact of noise is not a function of loudness alone. Most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors have been developed. One of the most frequently used noise metrics is the equivalent noise level (L_{eq}); it considers both duration and sound power level. L_{eq} is defined as the single steady A-weighted level equivalent to the same amount of energy as that contained in the actual fluctuating levels over time. Typically, L_{eq} is summed over a one-hour period. L_{max} is the highest root-mean-square (RMS) sound pressure level in the sampling period, and L_{min} is the lowest RMS sound pressure level in the measuring period (Crocker 2007).

Noise that occurs at night tends to be more disturbing than that occurring during the day. Community noise metrics are usually measured using Day-Night Average Level (L_{dn}), which is the 24-hour average noise level with a +10 dBA penalty for noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. It is also measured using Community Noise Equivalent Level (CNEL), which is the 24-hour average noise level with a +5 dBA penalty for noise occurring from 7:00 p.m. to 10:00 p.m. and a +10 dBA penalty for noise occurring from 10:00 p.m. to 7:00 a.m. (Caltrans 2013). Noise levels described by L_{dn} and CNEL usually differ by about 1 dBA. The relationship between the peak-hour L_{eq} value and the L_{dn}/CNEL depends on the distribution of traffic during the day, evening, and night. Quiet suburban areas typically have CNEL noise levels in the range of 40 to 50 dBA, while areas near arterial streets are in the 50 to 60-plus CNEL range. Normal conversational levels are in the 60 to 65-dBA L_{eq} range; ambient noise levels greater than 65 dBA L_{eq} can interrupt conversations (Federal Transit Administration [FTA] 2018).

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning/studying
- Physiological effects such as hearing loss or sudden startling

These potential effects can be caused by both short- and long-term exposure to very loud noises and long-term exposure to lower levels of sound. However, there is no perfect way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction, including interference with communication and human speech. A wide variation exists in the individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise would be judged by those hearing it.

Nighttime noise can potentially affect sleep. Noise can make it difficult to fall asleep and create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages (Los Angeles World Airports [LAWA] 2012). In addition, noise can awaken people from sleep, although nighttime awakenings also occur independent of noise. People commonly attain full waking consciousness two or three times per night for reasons having nothing to do with noise exposure.

Health effects from noise have been studied around the world for nearly 30 years. Scientists have attempted to determine if high noise levels can adversely affect human health apart from auditory damage. In a review of 30 studies conducted worldwide between 1993 and 1998, a team of international researchers concluded that, while some findings suggest that noise can affect health, improved research concepts and methods are needed to verify or discredit such a relationship. The team of international researchers called for more study of the numerous environmental and behavioral factors than can confound, mediate, or moderate survey findings. Until science refines the research process, a direct link between a single source noise exposure and non-auditory health effects remains to be demonstrated (LAWA 2012).

The Occupational Safety and Health Administration has an established noise exposure limit of 90 dBA for 8 hours per day (or higher for shorter duration exposures) to protect an individual from hearing loss (29 Code of Federal Regulations [CFR] 1910.95). Noise levels in neighborhoods, even near a major airport or a major freeway, are not sufficiently loud to cause hearing loss (LAWA 2012).

Vibration

Groundborne vibration of concern in environmental analysis consists of the oscillatory waves that move from a source through the ground to adjacent structures. The number of cycles per second of oscillation makes up the vibration frequency, described in terms of Hz. The frequency of a vibrating object describes how rapidly it oscillates. The normal frequency range of most groundborne vibration that can be felt by the human body starts from a low frequency of less than 1 Hz and goes to a high of about 200 Hz (Crocker 2007).

While people have varying sensitivities to vibrations at different frequencies, in general, they are most sensitive to low-frequency vibration. Vibration in buildings, such as from nearby construction activities, may cause windows, items on shelves, and pictures on walls to rattle. Vibration of building components can also take the form of an audible low-frequency rumbling noise, referred to as groundborne noise. Groundborne noise is usually only a problem when the originating vibration spectrum is dominated by frequencies in the upper end of the range (60 to 200 Hz), or when foundations or utilities, such as sewer and water pipes, physically connect the structure and the vibration source (FTA 2018). Vibration energy spreads out as it travels through the ground, causing the vibration level to quickly diminish with distance from the source. High-frequency vibrations diminish much more rapidly than low frequencies, so low frequencies tend to dominate the spectrum at large distances from the source. Discontinuities in the soil strata can also cause diffractions or channeling effects that affect the propagation of vibration over long distances (Caltrans 2020a). When a building is impacted by vibration, a ground-to-foundation coupling loss will usually reduce the overall vibration level. However, under rare circumstances, the ground-to-foundation coupling may actually amplify the vibration level due to structural resonances of the floors and walls.

Vibration amplitudes are usually expressed in peak particle velocity (PPV) or RMS vibration velocity. The PPV and RMS velocity are normally described in inches per second (in./sec.). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is often used in monitoring of blasting vibration because it is related to the stresses that are experienced by buildings (Caltrans 2020a).

The background vibration velocity level in residential and educational areas is usually or lower around 50 VdB, or 0.007 in./sec. PPV (FTA 2018). As described in greater detail below in Table 4.11-7, vibration at sufficient levels can result in damage to structures, depending upon the age and type of construction.

Ground vibration can be annoying to people. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is running on a treadmill (Caltrans 2020a).

Historic structures are considered more sensitive to vibration than regular structures, as such structures are usually of older, less competent construction, and lower vibration limits for them are often justified (Caltrans 2020a). Ground vibration also has the potential to disrupt the operation of vibration-sensitive research and advanced technology equipment (Caltrans 2020a). This equipment can include optical microscopes, cell probing devices, magnetic resonance imaging (MRI) machines, scanning electron microscopes, photolithography equipment, micro-lathes, and precision milling equipment. The degree to which this equipment is disturbed depends on the type of equipment, how it used, and its support structure. For example, equipment supported on suspended floors may be more susceptible to disturbance than equipment supported by an on-grade slab.

Existing Noise Setting

The campus is in a semi-urban, developed area. Land uses adjacent to East Campus include commercial uses, single- and multi-family residences, open space, and the I-215/SR 60 freeway. Land uses near West Campus include agriculture, commercial uses, single- and multi-family residences, and the I-215/SR 60 freeway. The primary sources of noise on-site and in the surrounding area are motor vehicles from roadways. The greatest vehicle noise would occur from vehicles on the I-215/SR 60 freeway and on the main thoroughfares (e.g., Big Springs Road, Blaine Street, North/South/East/West Campus Drive, Canyon Crest Drive, Central Avenue, West Linden Street, Martin Luther King Boulevard, University Avenue, and Watkins Drive). To establish the existing noise setting, the EIR considers previously measured noise levels, City of Riverside General Plan noise contours, other sources of noise on campus (e.g., construction noise and special event noise), and campus noise control programs, described below.

Measured Noise Levels

Due to the campus-wide shut down as a result of COVID-19, measuring the ambient noise around the campus during the year 2020 would not accurately represent the existing noise setting. Instead, noise measurements were used from previous projects on the UCR campus to evaluate existing noise levels which were taken prior to the COVID-19 shutdown. Table 4.11-1 through Table 4.11-4 show measurements taken during planning for the: (A) UCR Parking Structure 1 Project, (B) UCR Glen Mor 2 Student Apartments Project, (C) CARB Southern California Consolidation Project, and (D) the UCR North District Development Plan Project, respectively. The general noise measurement locations for each project are shown in Figure 4.11-1. These noise measurements are representative of noise levels in proximity to these locations.

Table 4.11-1 UCR Parking Structure 1 Noise Monitoring Results (Location A)

Measurement	Measurement Location	Sample Times[1]	Approximate Distance to Primary Noise Source	L_{eq} (dBA)
A1	Southeast corner of Parking Lot 13	10:25 – 10:40 a.m.	440 feet from traffic in Parking Lot 13	53.5
A2	Along Big Springs Road, north of Parking Lot 13, and south of the Glen Mor Student Residence Complex	11:31 – 11:46 a.m.	50 feet from landscaping equipment and traffic on Big Springs Road	58.8
A3	East side of Parking Lot 13	10:46 – 11:01 a.m.	45 feet from traffic on Big Springs Road	50.1
A4	Along Big Springs Road, east of Valencia Hill Drive, adjacent to off-campus residences	11:08 – 11:23 a.m.	45 feet from traffic on Big Springs Road	62.5

[1] Measurements performed on October 2,2019

Leq = equivalent noise level; dBA = A-weighted decibels

Source: UCR 2020

Table 4.11-2 UCR Glen Mor 2 Student Apartments Project Noise Monitoring Results (Location B)

Measurement	Measurement Location	Sample Times[1]	Noise Source	L_{eq} (dBA)
B1	Athletic fields	7:09 – 7:24 a.m.	Intramural football game; distant music; birds; distant aircraft; distant traffic	57.3
B2	3624 Valencia Hill Drive Riverside, CA 92507	7:28 – 7:43 a.m.	Intramural football game; distant music; birds; distant aircraft; distant traffic	52.6
B3	University Village Apartment Pool	10:45 – 11:00 a.m.	Traffic along West Big Springs road; birds	52.0
B4	University Village Apartment	11:08 – 11:23 a.m.	Traffic along West Big Springs road; birds	49.6
B5	3706 Valencia Hill Drive Riverside, CA 92507	11:39 – 11:54 a.m.	Traffic along Watkins Drive; birds	48.0
B6	3592 Valencia Hill Drive Riverside, CA 92507	12:02 – 12:17 p.m.	Traffic along Watkins Drive; birds; distant aircraft	49.0
B7	Common area of Glen Mor 1 student apartments north of project site	12:32 – 12:47 p.m.	Birds; distant aircraft	48.0

[1] Measurements performed on May 26, 2010 or May 27, 2010

Leq = equivalent noise level; dBA = A-weighted decibels

Source: UCR 2011

Table 4.11-3 CARB Southern California Consolidation Project Noise Monitoring Results (Location C)

Measurement	Measurement Location	Sample Times[1]	Description	L_{eq} (dBA)
C1	3996 Iowa Avenue Riverside, CA 92507	11:02 – 11:12 a.m.	East of Iowa Avenue, approximately 50 feet from the center line	64.7
C2	3993 Iowa Avenue Riverside, CA 92507	10:49 – 10:59 a.m.	West of Iowa Avenue, approximately 150 feet from the center line	49.7
C3	3993 Iowa Avenue Riverside, CA 92507	10:37 – 10:47 a.m.	West of Iowa Avenue, approximately 330 feet from the center line	48.1
C4	1414 Everton Place Riverside, CA 92507	10:12 – 10:22 a.m.	Southwest end of the basketball court	41.9
C5	3998 Cranford Avenue Riverside, CA 92507	9:43 – 9:53 a.m.	North of Cranford Avenue, approximately 40 feet from the center line	41.6
C6	3988 Cranford Avenue Riverside, CA 92507	9:30 – 9:40 a.m.	North of Cranford Avenue, approximately 30 feet from the center line	49.6

[1] Measurements performed on September 14, 2016

L_{eq} = equivalent noise level; dBA = A-weighted decibels

Source: CARB 2017

Table 4.11-4 UCR North District Development Plan Noise Monitoring Results (Location D)

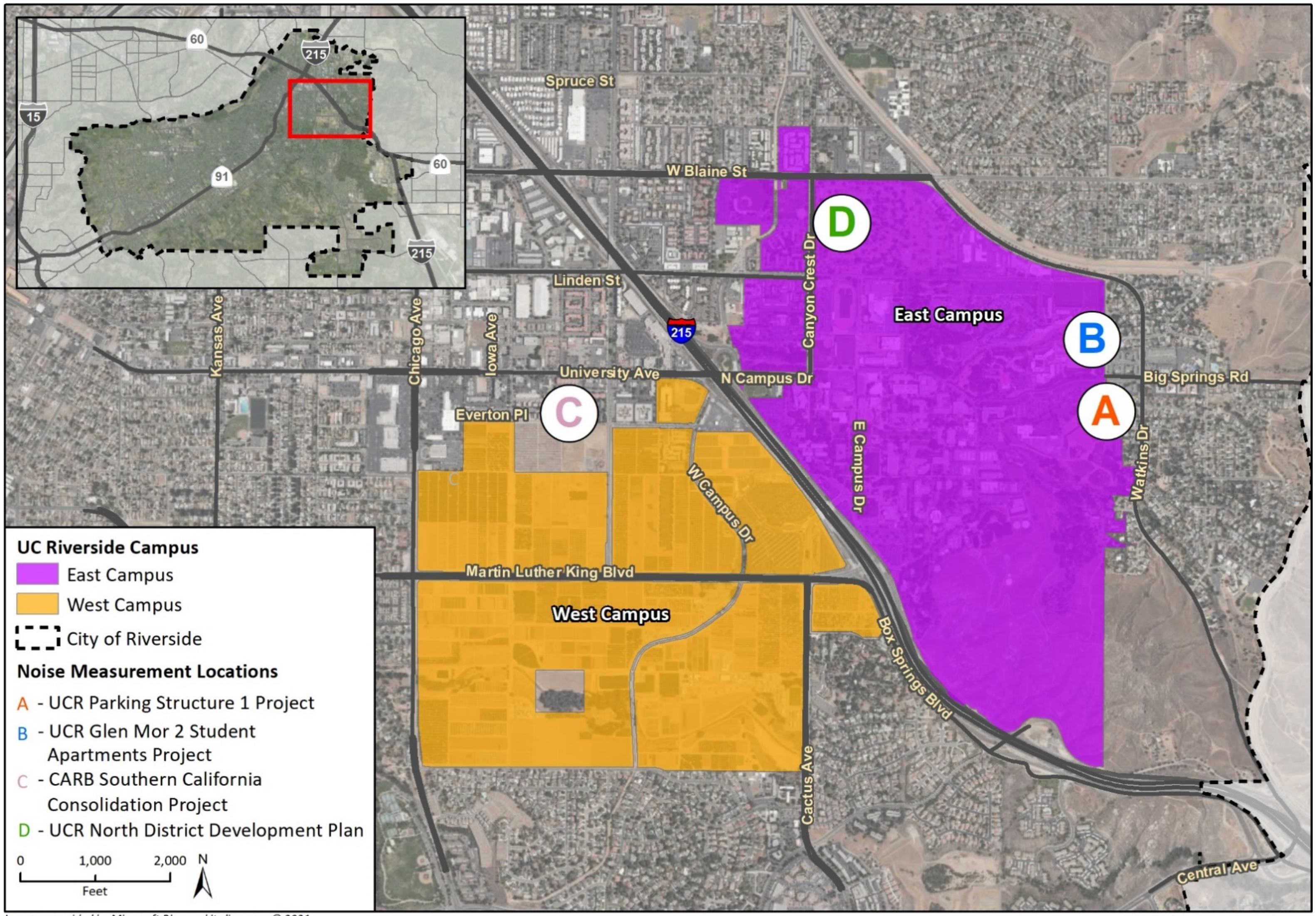
Measurement [1]	Measurement Location	L_{eq} (dBA)
D1	Abderdeen-Inverness Residence Hall	62.2
D2	Child Development Center	55.5
D3	Stonehaven Apartments	61.6
D4	Falkirk Student Apartments	59.6

[1] Measurements performed on October 4, 2018

L_{eq} = equivalent noise level; dBA = A-weighted decibels

Source: UCR 2019

Figure 4.11-1 Noise Measurement Locations



Imagery provided by Mircosoft Bing and its licensors © 2021.
Data provided by UC Riverside and County of Riverside, 2021.

FigX Noise Measurement Location Overview

City of Riverside General Plan Noise Contours

The City's Noise Element establishes existing (Year 2003) and future (Year 2025) noise contours for roadways, freeways, and railways, as well as noise contours for area airports (Riverside Municipal Airport, Flabob Airport, and March Air Reserve Base). The Year 2025 roadway noise contour map (Figure N-5 of the City's General Plan), identifies Martin Luther King Boulevard, University Avenue, and Iowa Avenue as having 60 CNEL, 65 CNEL, and 70 CNEL noise contours. The 60 CNEL contours on University Avenue and Iowa Avenue reach approximately 300 feet from the roadway centerlines; the 60 CNEL contour on Martin Luther King Boulevard reaches approximately 500 feet from the roadway centerline. The Year 2025 freeway noise contour map (Figure N-6 of the City's General Plan), show I-215 noise levels extending much further, with the 60 CNEL noise contour extending approximately 4,500 feet from freeway centerline, the 65 CNEL noise contour extending approximately 2,500 feet from freeway centerline, and the 70 CNEL noise contour extending approximately 1,500 feet from freeway centerline. For reference, a distance of 4,500 feet covers the majority of East Campus and West Campus; a distance of 1,500 feet extends out to campus buildings such as Pierce Hall, the Biological Sciences building, Picnic Hill, and Anderson Hall.

The 2025 railroad noise contour map (Figure N-7 of the City's General Plan), shows the railroad tracks that traverse adjacent to the northeastern corner of UCR, with a 60 CNEL railroad noise contour extending approximately 400 feet from the railway centerline. UCR is not located in noise contours for any area airports (Figures N-8 and N-9 of the City's General Plan).

Traffic Noise Levels

Existing noise levels from roadway traffic was calculated using the Baseline (Year 2018) Scenario from the LRDP's Traffic Operations Analysis (Reed 2021). These noise levels are shown in Table 4.11-5 and are representative of existing peak hour noise levels at 50 feet from the roadway centerlines in the area.

Table 4.11-5 Existing Calculated Traffic Noise Levels

Roadway	Segment	Approximate Peak Hour Noise Level (dBA L_{eq} at 50 feet from Roadway Centerline)
3rd Street	West of the I-215/SR 60 Freeway SB Ramps	63
	Between the I-215/SR 60 Freeway Ramps	66
Big Springs Road	West of Watkins Drive	58
	East of Watkins Drive	56
Blaine Street	West of Canyon Crest Drive	64
	East of Canyon Crest Drive	64
Campus Drive	South of University Avenue	61
Canyon Crest Drive	North of Blaine Street	56
	Between Blaine Street and West Linden Street	60
	Between West Linden Street and Campus Drive	62
	North of Martin Luther King Boulevard	64
	South of Martin Luther King Boulevard	68
Central Avenue	West of the I-215/SR 60 Freeway SB Ramps	68
	Between the I-215/SR 60 Freeway Ramps	68
	East of the I-215/SR 60 Freeway NB Ramps	68
West Linden Street	West of Canyon Crest Drive	59
	East of Canyon Crest Drive	60
Martin Luther King Boulevard	West of Canyon Crest Drive	68
	East of Canyon Crest Drive	68
	Between the I-215/SR 60 Freeway Ramps	66
University Avenue	West of the I-215/SR 60 Freeway SB Ramps	63
	Between the I-215/SR 60 Freeway Ramps	62
	Between the I-215/SR 60 Freeway NB Ramps and Campus Drive	62
Watkins Avenue	North of Big Springs Road	63
	South of Big Springs Road	62

See Methodology for calculation parameters; traffic volumes for the 2018 baseline scenario from Fehr & Peers (Reed 2021).

dBA = A-weighted decibels; Leq = equivalent noise level; I-215 = Interstate 215; SR 60 = State Route 60; SB = Southbound; NB = Northbound

Construction Noise

Construction occurs regularly on campus. Noise generated by construction activities is primarily isolated and limited to the immediate vicinity of each campus project site. The actual noise levels generated by construction vary by site and on a daily and hourly basis, depending on the activity that is occurring, and the types and number of pieces of equipment that are operating. Typical construction equipment noise levels are described under Methodology.

Special Event Noise

Noise is also generated by occasional special events at the UCR campus. These include events such as athletic meets at the campus track and outdoor concerts in the Academic Center and recreational areas of the campus. The loudest of these special events are outdoor concerts. Specific noise levels for each concert event cannot be defined since sound level expectations are different for various types of music; each act provides their own sound equipment, and each act selects the location of the speakers. In general, country music is presented at average sound levels in audience areas of approximately 90 dBA L_{eq}, while rock music typically averages sound levels of approximately 105 dBA L_{eq} (UCR 2005). The noise levels generated by the special events on East Campus primarily affect the academic, administrative, and student housing uses on campus, although they may be audible from off-campus residential neighborhoods to the north and east. No special events are anticipated on West Campus, as there are no existing or proposed facilities under the 2021 LRDP that would accommodate such events.

Campus Noise Control Programs

UCR implements numerous programs to reduce on- and off-campus noise levels. These programs are discussed below.

STATIONARY SOURCE NOISE CONTROLS

In order to provide a relatively quiet environment on the campus that is conducive to the educational process and to be mindful of off-campus sensitive uses (e.g., residential neighborhoods), noise-generating uses such as parking areas and heating, ventilation, and air conditioning (HVAC) units are designed and evaluated when designing specific individual new facilities to minimize the potential for noise impacts to adjacent campus buildings and off-campus sensitive uses (e.g., residential neighborhoods). In addition, building setbacks, architectural features, and orientation are used to reduce intrusive noise at sensitive student residential and educational building locations near main campus access routes.

LANDSCAPE BUFFERING

The campus provides landscaped buffering along the east edge of East Campus (Valencia Hill Drive Landscape Buffer Area) and central West Campus (Martin Luther King Boulevard Landscape Buffer Area). There is also landscaping (trees) along Canyon Crest Drive and University Avenue in West Campus that may accomplish sound reduction of campus noises to the adjacent community. These buffers increase the distance between on-campus uses and the surrounding area and provide an acoustically soft environment to further reduce noise levels. They also reduce noise levels that are generated in the surrounding area (primarily roadway noise) that are heard within the campus. Likewise, they reduce the noise levels that are generated on campus that are heard in the surrounding area. These buffers are implemented, in part, through the UCR Physical Design Framework, which states: “Provide sensitive land use transitions and landscaped buffers where residential neighborhoods might experience noise or light from UCR activities.”

CONSTRUCTION NOISE CONTROLS

As a standard condition of approval, UCR limits the hours of exterior construction activities from 7:00 a.m. to 9:00 p.m. Monday through Friday and 8:00 a.m. to 6:00 p.m. on Saturday, except under rare circumstances where such time limits are infeasible (e.g., for time sensitive construction work such as concrete pouring, excessive heat warnings/temperatures during the summer, operational emergencies). No exterior construction activities shall occur on federal holidays. Transportation routes for construction traffic onto campus have typically been through Blaine Street to Canyon Crest Drive; University Avenue to Canyon Crest Drive, West Campus Drive, or Iowa Avenue; or through Martin Luther King Boulevard to Canyon Crest Drive or Iowa Avenue.

VEHICULAR TRAFFIC NOISE CONTROLS

UCR is served by several modes of alternative transportation, including public bus services. The campus also implements an Alternative Transportation program that facilitates and promotes the use of transit, carpools, vanpools, and bicycling. (See Section 4.15, *Transportation,* for additional information.) The goal of the program is to reduce the total number of vehicle trips made to campus by faculty, staff, and students. While these programs were not implemented to reduce noise levels, they do have the positive effect of reducing the number of motor vehicle trips and associated noise that might otherwise be generated in association with the campus. By reducing the number of potential motor vehicle trips, the potential noise levels that could be experienced in the surrounding vicinity are, likewise, reduced.

Sensitive Receivers

Noise exposure goals for various types of land uses reflect the varying noise sensitivities associated with those uses. Noise sensitive uses typically include single- and multi-family residential (including residence halls), churches, hospitals and similar health care institutions, convalescent homes, libraries, laboratories, and schools. Noise sensitive receivers near the project site include single- and multi-family residences and churches. Noise sensitive receivers are also located throughout campus with residence halls, classrooms, laboratories, and the Tomás Rivera Library.

Vibration sensitive receivers are similar to noise sensitive receivers, such as residences and institutional uses (e.g., schools, libraries, and religious facilities). Vibration sensitive receivers also include laboratory uses. Vibration sensitive receivers near the project site include single- and multi-family residences and churches. Vibration sensitive receivers are also located throughout campus with residence halls, classrooms, laboratories, and the Tomás Rivera Library.

4.11.2 Regulatory Setting

Federal

Federal agencies that have developed noise standards include the Federal Highway Administration (FHWA), the Department of Housing and Urban Development, the Federal Interagency Committee on Urban Noise, and the Federal Aviation Administration. None of these federal noise laws, regulations, or policies for construction-related noise and vibration apply to the UCR campus.

However, aspects of the Federal Transit Administration (FTA) guidelines have been used for guidance in the analysis of the proposed 2021 LRDP's potential impacts. The FTA's *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018) provides standards for specific vibration-sensitive land uses such as laboratory settings. The FTA lists a "Residential Day" International Standards Organization (ISO) use, which is vibration that is barely felt and adequate for low-power optical microscopes, as having a vibration criteria of 78 vibration decibels (equivalent to 0.032 in./sec. PPV. For the purposes of analysis, a "Residential Day" ISO use is considered representative of laboratory settings on campus.

State

California Noise Control Act of 1973

California Health and Safety Code Sections 46000 through 46080, known as the California Noise Control Act, find that excessive noise is a serious hazard to public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. The act also finds that there is a continuous and increasing bombardment of noise in urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians that is free from noise that jeopardizes their health or welfare.

California Building Code

The UC has adopted the CBC as its building code for campus development. Requirements for sound transmission between adjacent dwelling or sleeping units, and between public areas and dwelling units or sleeping units is described under Part 2, Volume 1, Chapter 12, Section 1206 of the 2019 CBC (CBC 2019). Per Section 1206.4 of this revised CBC, allowable interior noise levels attributed to external sound sources must not exceed 45 dB CNEL (or Ldn). Section 1206.5 directs the reader to the California Green Building Standards Code, Chapter 5, Division 5.5 for additional sound transmission requirements (as they relate to non-residential land uses).

Title 24, Part 11, Section 5.507 specifies environmental comfort with regard to noise exposure for non-residential buildings. Except buildings having few or no occupants, or where occupants are not likely to be affected by exterior noise, the subsections therein provide means of acoustical controls through which building assembly and component requirements are used to assess exterior noise issues. Section 5.507.4 stipulates two compliance approaches. The prescriptive method is utilized when occupied structures are planned with a 65 dBA CNEL contour of an airport, railroad, highway traffic, or industrial noise source. In this case, the wall and roof-ceiling assemblies are required to achieve a composite sound transmission class (STC) rating of at least 50, or a composite outdoor-indoor transmission class (OITC) rating of not less than 40. Additionally, exterior windows are required to be rated with a minimum STC of 40, or OITC of 30. The performance method does not require specific STC and OITC ratings; however, it requires that the interior noise environment attributable to outdoor noise sources not exceed 50 dBA L_{eq} (1 hour). This noise level can be achieved by means of building envelope construction and/or exterior features such as noise walls or berms. The performance method requires an acoustical analysis documenting compliance with the interior sound level limits.

Caltrans Vibration Guidelines

The *Transportation and Construction Vibration Guidance Manual* provides guidance on vibration issues associated with the construction, operation, and maintenance of Caltrans projects (Caltrans 2020a). These guidelines address vibration-related annoyance to people, vibration-related damage to structures, and vibration-related adverse effects to sensitive equipment. This manual also addresses vibration prediction and screening assessment for construction equipment, methods that can be used to reduce vibration effects from transportation and construction sources, general procedures for addressing vibration issues, and vibration measurement and instrumentation.

For human annoyance potential, as shown in Table 4.11-6, Caltrans' vibration level threshold at which transient vibration sources (such as construction equipment) are considered to be distinctly perceptible is 0.24 in./sec. PPV.

Table 4.11-6 Human Response to Transient Vibration

PPV (in./sec.)	Human Response
2.0	Severe
0.9	Strongly perceptible
0.24	Distinctly perceptible
0.035	Barely perceptible

Source: Caltrans 2020a

PPV = peak particle velocity; in./sec. = inches per second

Maximum recommended vibration limits for preventing damage to structure listed by Caltrans from the American Association of State Highway and Transportation Officials (AASHTO) are identified in Table 4.11-7.

Table 4.11-7 AASHTO Maximum Vibration Levels for Preventing Damage

Type of Situation	Limiting Velocity (in./sec.)
Historic sites or other critical locations	0.1
Residential buildings, plastered walls	0.2–0.3
Residential buildings in good repair with gypsum board walls	0.4–0.5
Engineered structures, without plaster	1.0–1.5

Source: Caltrans 2020a

AASHTO = American Association of State Highway and Transportation Officials; in,/sec. = inches per second

Regional and Local (Non-Binding)

As noted in Section 4, "University of California Autonomy," UCR, a constitutionally-created State entity, is not subject to municipal regulations of surrounding local governments for uses on property owned or controlled by UCR that are in furtherance of the university's educational purposes. However, UCR may consider, for coordination purposes, aspects of local plans and policies of the communities surrounding the campus when it is appropriate and feasible but is not bound by those plans and policies in its planning efforts.

Riverside County Airport Land Use Commission

The Riverside County Airport Land Use Compatibility Plan (ALUCP) establishes various policies and compatibility maps for individual ALUCP airports, including the March Air Reserve Base/Inland Port Airport. Riverside County Airport Land Use Commission (ALUC) review is required when a project is located within the boundaries of an Airport Influence Area and the project proposes a legislative action like a General Plan Amendment, Specific Plan Amendment, Zone Change, or Zoning Ordinance. Riverside County ALUCP also identifies noise contours from the airport.

4.11.3 Environmental Impacts and Mitigation Measures

Significance Criteria

UCR utilizes the following 2020 CEQA Guidelines Appendix G significance criteria questions related to Noise and Vibration.

Would the proposed 2021 LRDP result in:

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the LRDP in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b) Generation of excessive groundborne vibration or groundborne noise levels?

c) Exposure to people residing or working in the project area to excessive noise levels for a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport?

Issues Not Evaluated Further

All criteria questions related to Noise and Vibration are addressed herein.

Analysis Methodology

For the purposes of analysis of threshold "a," noise impacts would be considered significant if the campus project resulted in the following:

- Construction activities lasting more than 1 day that increase the ambient noise levels by 10 dBA L_{eq} or more over an 8-hour period at on-campus or off-campus noise-sensitive land uses
- A permanent (i.e., long term operational) increase of 5 dBA L_{eq} over ambient noise levels at on-campus or off-campus noise-sensitive land uses

As discussed previously in this section, a noise level increase of 3 dBA is barely perceptible to most people, a 5 dBA increase is readily noticeable, and an increase of 10 dBA would be perceived as a doubling of loudness.

The CEQA Guidelines also do not define the levels at which groundborne vibration or groundborne noise is considered "excessive." Therefore, the following Caltrans and FTA vibration standards are used in this analysis:

- For human receivers, the vibration level threshold to determine significance is 0.24 in./sec. PPV, which is the level at which transient vibration sources (such as construction equipment) are considered to be distinctly perceptible.
- For residential structures, the vibration level threshold to determine significance is 0.4 in./sec. PPV.
- For historical structures, the vibration level threshold is 0.1 in./sec. PPV.
- For on-campus laboratory uses, the vibration threshold is 0.032 in./sec. PPV.

Construction Noise

Construction noise was estimated using the FHWA Roadway Construction Noise Model (RCNM) (FHWA 2006). RCNM predicts construction noise levels for a variety of construction operations based on empirical data and the application of acoustical propagation formulas. RCNM provides reference noise levels for standard construction equipment, with an attenuation of 6 dBA per doubling of distance for stationary equipment. Using RCNM, potential construction noise levels were estimated at noise-sensitive receivers near the proposed 2021 LRDP development area. The development area under the proposed 2021 LRDP would occur primarily in previously disturbed areas, adjacent to previously developed areas, surface parking areas, generally along North/South/East/West Campus Drive, and generally along University Avenue, Canyon Crest Drive, Big Springs Road, Aberdeen Drive, and West Linden Street. Additionally, development under the 2021 LRDP would primarily be infill development or expansion of already developed areas. New development on West Campus may occur in the Agricultural/Campus Research, Student Neighborhood, Campus Support, and University Avenue Gateway designations. Some minor development may occur in other areas of campus (e.g., maintenance shed construction, restroom construction, UCR Botanic gardens interpretative center, etc.).

Variation in power imposes additional complexity in characterizing the noise source level from construction equipment. Power variation is accounted for by describing the noise at a reference distance from the equipment operating at full power and adjusting it based on the duty cycle of the activity to determine the L_{eq} of the operation (FHWA 2018). Each phase of construction has a specific equipment mix, depending on the work to be accomplished during that phase. Each phase also has its own noise characteristics; some will have higher continuous noise levels than others, and some have high-impact noise levels.

For general construction activities, construction noise would typically be higher during the heavier periods of initial construction (i.e., site preparation and grading work) and would be lower during the later construction phases (i.e., interior building construction). Typical heavy construction equipment during project grading and site preparation would include bulldozers, excavators, front-end loaders, dump trucks, and graders. Activities known to generate high noise levels, such as pile driving, breaking, and blasting, are not anticipated to occur under the proposed 2021 LRDP. Typical construction equipment noise levels from RCNM that may be used on campus are provided in Table 4.11-8.

Table 4.11-8 Typical Construction Equipment Noise Levels

Equipment	Acoustical Usage Factor (%)[1]	dBA L_{max} at 50 feet
Auger Drill Rig	20	84
Backhoe	40	78
Compactor (ground)	20	83
Concrete Mixer Truck	40	79
Crane	16	81
Dozer	40	82
Dump Truck	40	76
Excavator	40	81
Flat Bed Truck	40	74
Front End Loader	40	79
Generator	50	81
Grader	40	85
Pickup Truck	40	75
Pneumatic Tools	50	85
Roller	20	80
Scraper	40	84
Warning Horn	5	83
Welder/Torch	40	74

[1] The average fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation.

Source: FHWA 2006

dBA = A-weighted decibels; L_{max} = highest root-mean-square

It is assumed conservatively that diesel engines would power all construction equipment. Construction equipment would not all operate at the same time or location due to the different tasks performed by each piece of equipment. In addition, construction equipment would not be in constant use during the day. Specific construction-related details (e.g., location, schedule, equipment) for individual campus projects are unknown at this time. Therefore, example construction noise impacts were modeled assuming an excavator, loader, and dump truck operating together due to their potential of being used in conjunction with one another and therefore a conservative scenario for the greatest noise generation during general construction activities. Using RCNM to estimate noise associated with construction equipment, maximum hourly noise levels are calculated to be 79.9 dBA L_{eq} at 50 feet (RCNM calculations are included in Appendix I).

Groundborne Vibration

There are no substantial vibration sources associated with operation of UCR which would be affected by buildout under the 2021 LRDP. Thus, only construction activities have the potential to generate ground-borne vibration affecting nearby sensitive receivers, especially during grading and excavation of a campus project site. The greatest vibratory source during construction in a project area would be a vibratory roller. Activities known to generate high vibration levels, such as pile driving, breaking, and blasting, are not anticipated to occur under the proposed 2021 LRDP. Construction vibration estimates are based on vibration levels reported by the FTA (FTA 2018).

Table 4.11-9 shows typical vibration levels for various pieces of construction equipment used in the assessment of construction vibration.

Table 4.11-9 Vibration Levels Measured during Construction Activities

Equipment	PPV at 25 feet (in./sec.)
Vibratory Roller	0.210
Hoe Ram	0.089
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozer	0.003

Source: FTA 2018

PPV = peak particle velocity; in./sec. = inches per second

Although groundborne vibration is sometimes noticeable in outdoor environments, it is almost never annoying to people who are outdoors and the vibration level threshold for human perception is assessed at occupied structures (FTA 2018). Therefore, vibration impacts are assessed at the structure of an affected property.

Operational Noise Sources

Operational noise sources would include landscape maintenance which occurs under baseline conditions, general site activities (e.g., students conversing), mechanical equipment associated with buildings (e.g., HVAC units), emergency generators, parking structures, special events, and vehicular traffic. Landscape maintenance and general site activities are not considered substantial noise generators due to the distances and low noise levels associated with these sources, the short duration of use, and the lack of anticipated change associated with development of the 2021 LRDP; therefore, those two areas are not discussed further. Similar to construction noise impacts, operational noise impacts are also analyzed at exterior use areas of “frequent human use[1].”

MECHANICAL EQUIPMENT

Mechanical HVAC units would have the potential to generate noise levels that run continuously during the day and night. HVAC units are assumed to be installed on the rooftops of each building. Specific planning information is not available for the HVAC units at this time; modeling assumed the use of large rooftop units, Trane QuietCurb units, that can range from 20 to 130 tons. The unit’s exhaust fan return generates a sound power level of 97.1 dBA. Manufacturer’s specifications for the HVAC unit are included in Appendix I.

EMERGENCY GENERATORS

During normal campus operation, the emergency generators would not be operated other than for periodic testing, maintenance requirements, and during emergencies. To ensure the generators

[1] Caltrans defines areas of “frequent human use” as areas where people are exposed to noise for an extended period of time on a regular basis (Caltrans 2020b).). For example, Caltrans states that a parking lot would not be an area of frequent human use as people are only in a parking lot for a few minutes, whereas areas with amenities for people to use (e.g., benches, barbeque facilities, covered group picnic areas, and uncovered picnic tables) would be used for hours at a time.

would be operational during an emergency, testing is anticipated to occur once a month for approximately 30 minutes to 1 hour. Other than the testing of the generators, they would only be in use during emergency situations.

PARKING STRUCTURES

Noise sources associated with the operation and use of parking structures include both intermittent and continuous sources of noise. The most prevalent intermittent sources include tire noise, car alarms, vehicle engine idling, and shutting of vehicle doors. Based on FTA guidance (FTA 2018), reference sound exposure levels (SEL) for a parking structure with 1,000 vehicle car capacity at peak hour is 92 dBA at the center of the structure, and noise levels at 50 feet may be estimated from the following equation:

$$L_{eq(1-hour)} = SEL_{reference} - 35.6$$

Therefore, per the equation, noise levels at 50 feet from a center of a parking structure during peak hour with 1,000 vehicles are estimated to be 56.4 dBA Leq (1 hour).

SPECIAL EVENTS

Under the 2005 LRDP, noise would continue to be generated by occasional special events at the UCR campus, such as athletic meets at the campus track and outdoor concerts in the Academic Center and recreational areas of the campus. The loudest of these would continue to be the outdoor concerts. These special events would be similar to those that occur under the existing baseline conditions.

TRAFFIC NOISE

LRDP-generated traffic would increase noise levels on surrounding roadways, including on 3rd Street/Blaine Street, Big Springs Road, Blaine Street, North/South/East/West Campus Drive, Canyon Crest Drive, Central Avenue, West Linden Street, Martin Luther King Boulevard, University Avenue, and Watkins Drive. To determine the off-site traffic noise level increase from the proposed 2021 LRDP, traffic noise was modeled using FHWA's Traffic Noise Model (TNM) traffic noise-reference levels. The model is a conservative, straight line model that does not consider attenuation from topography or buildings. Traffic noise was modeled for the following scenarios provided in the proposed 2021 LRDP Traffic Operations Analysis (Reed 2021): Baseline (2018), Baseline Plus Project (2018), Cumulative (2035), and Cumulative Plus Project (2035). The provided average daily trips (ADT) volumes are shown in Table 4.11-10. The traffic speeds utilized in the model, determined by the most applicable speed limit signs on or near each segment, are also shown in Table 4.11-11. Please see Section 4.15, *Transportation*, for additional information regarding transportation impact analyses, including cumulative growth assumptions.

Table 4.11-10 Existing and Future Traffic Volumes

Roadway	Segment	Speed Limit	Traffic Counts (Average Daily Trips) Baseline (2018)	Baseline Plus Project (2018)	Cumulative (2035)[1]	Cumulative Plus Project (2035)
3rd Street	West of the I-215/SR 60 Freeway SB Ramps	40	25,822	27,698	34,074	35,951
	Between the I-215/SR 60 Freeway Ramps	40	27,873	32,802	36,809	41,738
Big Springs Road	West of Watkins Drive	30	5,374	8,205	7,092	9,922
	East of Watkins Drive	30	3,562	3,721	4,707	4,866
Blaine Street	West of Canyon Crest Drive	40	18,079	24,789	23,866	30,576
	East of Canyon Crest Drive	40	18,635	24,725	24,598	30,688
North/South/ East/West Campus Drive	South of University Avenue	25	11,480	11,893	15,153	15,566
Canyon Crest Drive	North of Blaine Street	25	3,800	3,800	5,009	5,009
	Between Blaine Street and West Linden Street	35	9,000	11,655	11,862	14,517
	Between West Linden Street and Campus Drive	35	13,706	17,792	18,079	22,165
	North of Martin Luther King Boulevard	45	14,342	18,333	18,937	22,928
	South of Martin Luther King Boulevard	45	43,662	43,662	57,639	57,639
Central Avenue	West of the I-215/SR 60 Freeway SB Ramps	50	30,004	30,004	39,592	39,592
	Between the I-215/SR 60 Freeway Ramps	50	29,463	30,099	38,892	39,528
	East of the I-215/SR 60 Freeway NB Ramps	50	34,377	36,444	45,380	47,447
West Linden Street	West of Canyon Crest Drive	40	6,471	10,192	8,538	12,259
	East of Canyon Crest Drive	25	8,014	12,148	10,574	14,708
Martin Luther King Boulevard	West of Canyon Crest Drive	50	33,915	40,276	44,775	51,136
	East of Canyon Crest Drive	50	34,965	44,823	46,159	56,017
	Between the I-215/SR 60 Freeway Ramps	50	21,561	26,379	28,462	33,279
University Avenue	West of the I-215/SR 60 Freeway SB Ramps	35	16,552	17,665	21,847	22,960
	Between the I-215/SR 60 Freeway Ramps	35	15,248	17,999	20,130	22,881
	Between the I-215/SR 60 Freeway NB Ramps and Campus Drive	35	14,930	19,414	19,716	24,200

Roadway	Segment	Speed Limit	Traffic Counts (Average Daily Trips) Baseline (2018)	Baseline Plus Project (2018)	Cumulative (2035)[1]	Cumulative Plus Project (2035)
Watkins Drive	North of Big Springs Road	35	16,043	17,745	21,195	22,897
	South of Big Springs Road	35	14,867	16,950	19,637	21,720

[1] See Section 4.15, *Transportation,* for additional information regarding transportation impact analyses, including cumulative growth assumptions

Source: Reed 2021

I-215 = Interstate 215; SR 60 = State Route 60; SB = Southbound; NB = Northbound

Table 4.11-11 Noise Levels Generated by Truck Activity at Delivery Areas

Noise-Generating Activity	Noise Level (dB L_{max}) at 50 feet
Idling 18-wheel heavy truck	64-65
Truck with trailer driving at 5 mph	65
Truck with trailer driving at 10 mph	66-68
Truck revving engine	69-80
Truck releasing air brakes at a stop	74-86

dB = decibel; L_{max} = highest root-mean-square; mph = miles per hour

Source: University of California, Santa Cruz 2021

To determine the vehicle classification mix for modeling for roadway segments, a typical, industry standard traffic mix was used: 94 percent automobiles, 4 percent medium trucks, and 2 percent heavy trucks. In accordance with the Traffic Operations Analysis assumptions, peak hour traffic was assumed to be 6.3 percent of ADT (Reed 2021).

2021 LRDP Objectives and Policies

There are no objectives or policies in the proposed 2021 LRDP related to noise and vibration.

Impact Analysis

Impact N-1 Generate Substantial Temporary or Permanent Increase in Ambient Noise Levels.

CONSTRUCTION EQUIPMENT USED DURING CONSTRUCTION AND MECHANICAL EQUIPMENT USED DURING OPERATION OF THE PROPOSED 2021 LRDP WOULD RESULT IN NOISE LEVEL INCREASES THAT WOULD EXCEED APPLICABLE NOISE THRESHOLDS, RESULTING IN A SIGNIFICANT IMPACT. MITIGATION MEASURE MM N-1 WOULD REDUCE CONSTRUCTION NOISE LEVELS TO THE EXTENT FEASIBLE, BUT IMPACTS WOULD REMAIN SIGNIFICANT AND UNAVOIDABLE. MITIGATION MEASURE MM N-2 WOULD REDUCE OPERATIONAL NOISE LEVELS TO LESS THAN SIGNIFICANT.

Construction

The nearest noise-sensitive receivers to construction activities undertaken under the proposed 2021 LRDP would be on-campus uses such as residential and academic/lab areas, and off-site single-family and multi-family residential areas. Other noise sensitive uses are in proximity to the UCR Campus; however, construction noise levels would be reduced at these locations in comparison to these structures, due to their increased distance from the campus and associated construction activity. Construction noise was evaluated at exterior use areas (i.e., outdoor areas of frequent human use) for the noise-sensitive receivers. Caltrans defines areas of "frequent human use" as areas where people are exposed to noise for an extended period of time on a regular basis (Caltrans 2020b). For example, Caltrans states that a parking lot would not be an area of frequent human use as people are only in a parking lot for a few minutes, whereas areas with amenities for people to use (e.g., benches, barbeque facilities, covered group picnic areas, and uncovered picnic tables) would be used for hours at a time. This analysis uses the Caltrans definition to determine where noise impacts may occur.

As discussed above, UCR includes limits on construction hours from 7:00 a.m. to 9:00 p.m. Monday through Friday and 8:00 a.m. to 6:00 p.m. on Saturday as a standard condition of approval. While exceptions are made for time-sensitive construction work, such as concrete pouring and operational emergencies or during excessive heat/temperature, which can disturb neighboring sensitive receivers and students sleeping or studying, these construction hours do not occur often compared to the overall duration of the construction activities. Over the course of a typical construction day, construction equipment would be located as close as 25 feet to the nearest noise-sensitive campus uses and to the nearest off-site multi-family residential buildings (the multi-family complexes to the west of East Campus on West Linden Street) and approximately 50 feet to the nearest off-site single-family residences (to the east of East Campus across Valencia Hill Drive), but would typically be located at an average distance further away due to the nature of construction (i.e., each piece of construction equipment would work in different locations throughout the day and average a further distance). Therefore, it is conservatively assumed that over the course of a typical construction day, the construction equipment would operate, on average, approximately 75 feet from the nearest noise-sensitive campus uses and off-campus multi-family residences and approximately 100 feet from the nearest off-site single-family residential buildings. These distances are assumed to exterior use areas (i.e., outdoor areas of frequent human use) for the noise-sensitive receivers.

At 75 feet and 100 feet, an excavator, loader, and a dump truck would generate a noise level of 76.4 dBA L_{eq} (8 hour) and 73.9 dBA L_{eq} (8 hour), respectively (RCNM calculations are included in Appendix I). As shown in Table 4.11-1, Table 4.11-2, and Table 4.11-4, ambient noise levels on and near the East Campus ranged from 48.0 dBA L_{eq} to 62.5 dBA L_{eq}. As shown in Table 4.11-3, ambient noise levels near the West Campus ranged from 41.6 dBA L_{eq} to 64.7 dBA L_{eq} (the lowest noise levels occurring south of Cranford Avenue, approximately 1,000 feet from the nearest main throughfare in an agricultural area). Therefore, potential construction noise levels of up to 76.4 dBA L_{eq} (8 hour) would exceed on-campus and off-campus ambient noise levels at exterior use areas by more than 10 dBA L_{eq} (8-hour), and construction noise impacts would be **significant**.

Operation

Existing campus and off-campus noise-sensitive receivers may periodically be subject to new noise associated with new uses under the proposed 2021 LRDP, which includes stationary noise from mechanical equipment, parking structures, special events similar to baseline conditions, on-campus gatherings, loading docks, and increased traffic, as discussed below. However, redevelopment of existing structures may also result in acoustical benefits, as older equipment is replaced with modern, quieter, more efficient equipment. Additionally, new structures can act as acoustical barriers to existing noise sources, depending upon their location.

Mechanical Equipment

For exterior use areas of noise-sensitive receivers, which are typically located on the ground level, and given that campus buildings would be multiple stories in height, an extra 30 feet was added to the horizontal distance to the nearest noise-sensitive receivers to account for the vertical distance. While buildings may be placed near existing on-campus and off-campus noise sensitive receivers, there would be setback distances and the HVAC systems would typically be located at an inner location of rooftops. It is assumed that there would be setback distances of 20 feet from the nearest exterior use areas, plus another 50 feet from the rooftop edge. In addition, as HVAC units would be located at a setback from the rooftop edge, the rooftop edge would provide a shielding affect by blocking the line-of-sight between the unit and the exterior use areas at ground level. This is conservatively assumed to result in a 5 dBA reduction at exterior use areas.

With distance attenuation and rooftop screening, a 130-ton Trane QuietCurb would generate an approximate noise level of 54.4 dBA L_{eq} at 100 feet (the total distance from the unit to the exterior use areas of the nearest noise-sensitive receivers). As shown in Table 4.11-1 through Table 4.11-4, ambient noise levels on and near the campus ranged from 41.6 dBA L_{eq} to 64.7 dBA L_{eq}. Therefore, where ambient noise levels are 49.4 dBA L_{eq} or lower, HVAC units may exceed 5 dBA above ambient. Operational noise impacts from mechanical equipment would be **significant**.

Emergency Generators

During normal campus operation, the emergency generators would not be operated other than for periodic testing and maintenance requirements. To ensure the generators would be operational during an emergency, testing is anticipated to occur once a month for approximately 30 minutes to 1 hour during the daytime hours (i.e., 6:00 a.m. to 5:00 p.m.). Other than testing, generators would only be used during emergency operations for continued periods of time during rare power outages or building equipment malfunctions and, therefore, do not substantially contribute to permanent increases in average ambient noise levels. In addition, noise generated due to emergency work is typically exempt from noise ordinances; for example, Section 7.35.020 of the City of Riverside Municipal Code exempts emergency sound from City noise standards. Thus, due to the infrequent, intermittent, and temporary use characteristics of these noise sources, in combination with the fact that typical maintenance activity would occur during the less sensitive times of the day and be cognizant of sensitive uses, noise generated from new emergency generators would not be considered a substantial permanent increase in noise that could result in noise level increases that would exceed applicable noise thresholds and impacts would be **less than significant**.

Parking Structures

Per Figure F3.5, Circulation Framework, of the Draft LRDP, proposed parking structures are envisioned along the periphery of campus in Parking Lot 30 north of Martin Luther King Boulevard and west of Canyon Crest Drive, at the UCR Extension site between University Avenue and Everton Place and east of Iowa Avenue, west of Canyon Crest Drive and south of West Linden Street, and two parking structures in the North District Development area between West Linden Street and Blaine Street and west of Watkins Drive. As described under Methodology, a parking structure with a 1,000-vehicle car capacity at peak hour would generate a noise level of 56.4 dBA L_{eq} at 50 feet from the center of the parking structure. A parking structure could be similar in size to Parking Structure 1, which is approximately 300 feet by 300 feet in size (UCR 2020). A conservative assumption would be for a parking structure to be adjacent to an exterior use area of a noise-sensitive land use, with a 50-foot setback buffer, which would result in a 200-foot distance from parking structure center to the receiver. This would result in a noise level of 44.4 dBA L_{eq}. As shown in Table 4.11-1, Table 4.11-2, and Table 4.11-4, ambient noise levels on and near the East Campus ranged from 48.0 dBA L_{eq} to 62.5 dBA L_{eq}. Therefore, parking structure noise would not exceed the ambient noise level by more than 5 dBA, and impacts would be **less than significant**.

SPECIAL EVENTS

Implementation of the proposed 2021 LRDP would not necessarily increase the number of special events. No specific plans related to future locations, type, and frequency of special events have been identified. However, the actual noise levels generated by future special events would be similar to existing conditions. Large events, such as graduation and student orientation, concerts such as Spring Splash and Block Party, are a part of the existing conditions, occur infrequently, and are required to follow UC policies regarding large events, obtaining the applicable permits when necessary. Noise generated by additional numbers of persons assembled at an event (because of proposed increase in campus population) would typically not be the primary source of noise when compared to noise from amplified systems. In addition, special events on interior portions of the campus would be screened from adjacent locations by campus buildings. As such, these events would not result in substantial temporary or periodic increases in ambient noise levels compared to existing conditions that include similar events. Impacts would be **less than significant**.

ON-CAMPUS GATHERINGS

Development throughout campus as implemented under the proposed 2021 LRDP would likely include small gathering spaces such as courtyards where groups would occasionally meet, such as for student clubs or academic functions. Although these on-campus gatherings would not utilize broadly amplified sound through large loudspeakers, small, portable speakers may occasionally be used to project music or speech in the direct vicinity of the gathering. Such gatherings would involve a small number of people, occur intermittently and would be required to follow all UCR policies related to noise and events. In addition, these events are similar to activities occurring under existing conditions. Therefore, on-campus gatherings are not anticipated to expose off-site receivers to noise levels that would exceed applicable standards. Impacts would be **less than significant**.

LOADING DOCKS

Some buildings constructed as part of the 2021 LRDP may have loading docks or designated areas for receiving shipments by commercial trucks. Noise generated by loading docks would be similar in nature by virtue of the primary noise source for both uses being truck activity. Noise sources from truck activity associated with delivery areas are usually short-term and can include activities such as vehicle idling, engine revving, and the release of air brakes on heavy trucks. Measured noise levels for these noise-generating activities are summarized in Table 4.11-11. Most of the noise-generating activities listed in Table 4.11-11 last for a period ranging from a few seconds (e.g., release of air brakes) to a few minutes (e.g., idling) and can reoccur multiple times during a single truck visit. As shown in Table 4.11-11, the loudest measured truck-related noise is the release of a truck's air brakes after it comes to a stop, which generates noise levels as high as 86 dB L_{max} at 50 feet. Based on the highest noise level (86 dB L_{max} at 50 feet) listed in Table 4.11-11, noise levels would attenuate to not exceed 46.6 dBA L_{eq} (5 dBA over the lowest measured ambient noise level) at a distance of 5,000 feet. Depending on the distance to noise-sensitive receivers, intervening shielding, and noise-reduction features incorporated into the loading dock, on- or off-campus noise-sensitive receivers located close to on-site delivery areas could be exposed to noise levels that exceed 5 dBA over ambient, and impacts would be **significant**.

CORPORATION YARD

The 2021 LRDP proposes that the Corporation Yard moves from East Campus to the Campus Support land use area on West Campus. The new location of the Corporation Yard on West Campus would be proximate to the I-215/SR 60 freeway, agricultural fields, International Village, and off-campus multiple-family residences along Everton Place.

The Corporation Yard would continue to be used for storage of fleet vehicles and equipment (e.g., garbage trucks, maintenance trucks), as well as for providing operational maintenance and support facilities such as vehicle fueling facilities, repair facilities, and office space. Noise generated by the Corporation Yard activities would be similar in nature by virtue of the primary noise source for both uses being vehicular activity. Noise sources from vehicular activity associated with the Corporation Yard are usually short-term and can include activities such as vehicle idling, engine revving, and the release of air brakes on heavy trucks. This would generate similar noise levels to the truck activity at delivery areas analyzed in Table 4.11-11. Based on the highest noise level (86 dB L_{max} at 50 feet) listed in Table 4.11-11, noise levels would attenuate to not exceed 46.6 dBA L_{eq} (5 dBA over the lowest measured ambient noise level) at a distance of 5,000 feet. Depending on the distance to noise-sensitive receivers, intervening shielding, and noise-reduction features incorporated into the corporation yard, on- or off-campus noise-sensitive receivers located close to the Corporation Yard could be exposed to noise levels that exceed 5 dBA over ambient, and impacts would be **significant**.

OFF-SITE TRAFFIC NOISE

Table 4.11-12 summarizes the traffic noise modeling results. As shown in the table, existing noise levels would increase by up to 2 dBA under the Baseline Plus Project scenario and 1 dBA under the Cumulative Plus Project scenario, which would not exceed the 3 dBA criteria for off-site traffic noise impacts. Therefore, traffic generated under the proposed 2021 LRDP would not result in a substantial permanent increase in ambient noise levels above levels existing without the 2021 LRDP-generated traffic. Impacts would be **less than significant**.

As described under *Effects of Noise on People*, effects of noise can be placed into three general categories: annoyance, interference with activities (e.g., speech, sleep, studying, etc.), and physiological effects (e.g., hearing loss). The potential for the previously identified construction and operational noise levels that exceed the ambient noise increase thresholds are discussed for their potential to result in annoyance, interference, or physiological effects below.

Construction noise was identified as a potentially significant impact as construction noise levels would potentially exceed 10 dBA L_{eq} over ambient. Construction noise may have the potential to be annoying or to interfere with activities such as speaking or studying. In addition, those who are having their speech or studying interfered with can typically relocate to a quieter location. Construction noise would typically not occur at nighttime when sleep may be disturbed. Hearing loss occurs at loud, sustained noise levels such as 90 dBA for 8 hours per day; noise-sensitive receivers would not be exposed to these noise levels.

Operational noise was identified as a potentially significant impact as noise levels from HVAC units, loading docks, and the Corporation Yard would potentially exceed 5 dBA L_{eq} over ambient. These sources may have the potential to be annoying or to interfere with activities such as speaking or studying. Loading docks and the Corporation Yard would typically not be used during the nighttime hours and would not disturb sleep. Although HVAC units could run during the nighttime, HVAC noise levels would typically not reach such a high level to be disturbing enough to interrupt sleep. Hearing loss occurs at loud, sustained noise levels such as 90 dBA for 8 hours per day; noise-sensitive receivers would not be exposed to these noise levels from these operational sources.

Table 4.11-12 Traffic Noise Levels

Roadway/Segment	Roadway Noise (dBA CNEL)[1]							
	Baseline	Baseline + Project	Noise Level Increase	Exceed Criteria?[2]	Cumulative	Cumulative + Project	Noise Level Increase	Exceed Criteria?[2]
3rd Street								
West of the I-215/SR 60 Freeway SB Ramps	66	66	0	No	67	67	0	No
Between the I-215/SR 60 Freeway Ramps	68	68	0	No	69	69	0	No
East of the I-215/SR 60 Freeway NB Ramps	69	70	1	No	70	71	1	No
Big Springs Road								
West of Watkins Drive	60	62	2	No	61	62	1	No
East of Watkins Drive	58	58	0	No	59	59	0	No
Blaine Street								
West of Canyon Crest Drive	66	67	1	No	67	68	1	No
East of Canyon Crest Drive	66	67	1	No	67	68	1	No
North/South/East/West Campus Drive								
South of University Avenue	63	63	0	No	64	65	1	No
Canyon Crest Drive								
North of Blaine Street	58	58	0	No	60	60	0	No
Between Blaine Street and West Linden Street	62	63	1	No	63	64	1	No
Between West Linden Street and Campus Drive	64	65	1	No	65	66	1	No
North of Martin Luther King Boulevard	65	66	1	No	67	67	0	No

Roadway/Segment	Roadway Noise (dBA CNEL)[1]							
	Baseline	Baseline + Project	Noise Level Increase	Exceed Criteria?[2]	Cumulative	Cumulative + Project	Noise Level Increase	Exceed Criteria?[2]
South of Martin Luther King Boulevard	70	70	0	No	71	71	0	No
Central Avenue								
West of the I-215/SR 60 Freeway SB Ramps	69	69	0	No	71	71	0	No
Between the I-215/SR 60 Freeway Ramps	69	69	0	No	70	71	1	No
East of the I-215/SR 60 Freeway NB Ramps	70	70	0	No	71	71	0	No
West Linden Street								
West of Canyon Crest Drive	61	63	2	No	62	64	2	No
East of Canyon Crest Drive	62	63	1	No	63	64	1	No
Martin Luther King Boulevard								
West of Canyon Crest Drive	70	71	1	No	71	72	1	No
East of Canyon Crest Drive	70	71	1	No	71	72	1	No
Between the I-215/SR 60 Freeway Ramps	68	69	1	No	69	70	1	No
University Avenue								
West of the I-215/SR 60 Freeway SB Ramps	65	65	0	No	66	66	0	No
Between the I-215/SR 60 Freeway Ramps	64	65	1	No	66	66	0	No
Between the I-215/SR 60 Freeway NB Ramps and Campus Drive	64	66	2	No	66	66	0	No

Roadway/Segment	Roadway Noise (dBA CNEL)[1]							
	Baseline	Baseline + Project	Noise Level Increase	Exceed Criteria?[2]	Cumulative	Cumulative + Project	Noise Level Increase	Exceed Criteria?[2]
Watkins Avenue								
North of Big Springs Road	65	65	0	No	66	66	0	No
South of Big Springs Road	64	65	1	No	66	66	0	No

[1] The modeled locations were at 50 feet from the roadway centerline.

[2] Criteria includes an increase of 5 dBA over existing traffic noise levels, or an increase of 3 dBA over existing traffic noise levels where the future resulting noise level would exceed 70 dBA CNEL.

CNEL = Community Noise Equivalent Level; dBA = A-weighted decibels; I-215 = Interstate 215; SR 60 = State Route 60; SB = Southbound; NB = Northbound

Mitigation Measures

MM N-1 Construction Noise Reduction Measures

To reduce construction noise levels to on-campus and off-campus noise sensitive receivers, UCR shall implement the following measures:

- Hours of exterior construction activities shall be limited to 7:00 a.m. to 9:00 p.m. Monday through Friday and 8:00 a.m. to 6:00 p.m. on Saturday, as feasible, except under circumstances where such time limits are infeasible (e.g., for time sensitive construction work such as concrete pouring, excessive heat warnings/temperatures during the summer, operational emergencies). No exterior construction activities shall occur on federal holidays.
- Construction traffic shall follow routes so as to minimize the noise impact of this traffic on the surrounding community, to the greatest extent feasible.
- Contract specifications shall require that construction equipment be muffled or otherwise shielded. Contracts shall specify that engine-driven equipment be fitted with appropriate noise mufflers.
- Where available and feasible, construction equipment with back-up alarms shall be equipped with either audible self-adjusting backup alarms or alarms that only sound when an object is detected. Self-adjusting backup alarms shall automatically adjust to 10 dBA over the surrounding background levels. All non-self-adjusting backup alarms shall be set to the lowest setting required to be audible above the surrounding noise levels.
- Stationary construction equipment material and vehicle staging shall be placed to direct noise away from sensitive receivers to the greatest extent feasible.
- Meetings shall be conducted, as needed, with on-campus constituents to provide advance notice of construction activities to coordinate these activities with the academic calendar, scheduled events, and other situations, as appropriate.
- Communication would be provided, as needed, with constituents that are affected by campus construction to provide advance notice of construction activities and ensure that the mutual needs of the particular construction project and of those impacted by construction noise are met, to the extent feasible.
- A sign shall be provided at the construction site entrance, or other conspicuous location, that includes a 24-hour telephone number for project information, and to report complaints. An inquiry and corrective action will be taken if necessary, in a timely manner.
- Where deemed necessary and feasible, installation of temporary sound barriers/blankets to break the line-of-sight between the construction equipment and exterior use areas of noise-sensitive receivers. The temporary barriers/blankets shall be of sufficient height to break the line-of-sight between the construction equipment and noise-sensitive receivers.

MM N-2 HVAC Noise Reduction Measures

The campus shall reduce HVAC equipment noise levels located in close proximity to noise-sensitive buildings and uses through noise control measures such as, but not limited to:

- Mechanical equipment screening (e.g., parapet walls)
- Equipment setbacks
- Silencers

- Acoustical louvers
- And other sound attenuation devices as made available

If a method other than mechanical equipment screening (e.g., parapet walls) is chosen, a project-specific design plan demonstrating that the noise level from operation of HVAC units does not generate noise levels that exceed 5 dBA above ambient at noise-sensitive receivers shall be completed.

MM N-3 Loading Dock Noise Reduction Measures

The campus shall reduce loading dock noise levels through measures such as, but not limited to:

- Noise levels from loading docks at noise-sensitive receivers shall not exceed 5 dBA over ambient noise levels, the effectiveness of which shall be determined on a project-level basis by an acoustical professional.
- As feasible, design and build sound barriers near loading docks and delivery areas that block the line of sight between truck activity areas and noise-sensitive receivers. Sound barriers may consist of a wall, earthen berm, or combination thereof.

MM N-4 Relocated Corporation Yard Noise Reduction Measures

If and when the campus Corporation Yard is relocated, the campus shall reduce Corporation Yard noise levels through measures such as, but not limited to:

- Noise levels from the Corporation Yard at noise-sensitive receivers shall not exceed 5 dBA over ambient noise levels, the effectiveness of which shall be determined on a project-level basis by an acoustical professional.
- As feasible, design and build sound barriers near the Corporation Yard that block the line of sight between truck activity areas and noise-sensitive receivers. Sound barriers may consist of a wall, earthen berm, or combination thereof.

Significance After Mitigation

With implementation of Mitigation Measure **MM N-1**, per manufacturer's specifications of sample equipment (see Appendix I), construction noise levels would be reduced by at least 10 dBA to 66.4 dBA L_{eq} (8 hour) at the closest exterior use areas of noise-sensitive receivers. However, these noise levels would still exceed median ambient noise levels by more than 10 dBA. Therefore, construction noise impacts would be **significant and unavoidable**.

Generally, blocking the line of sight from a noise source to a receiver will provide at least a 5 dBA reduction in source noise levels at the receiver (FHWA 2017). Therefore, with the implementation of Mitigation Measure **MM N-2**, operational noise levels would be reduced to 49.4 dBA L_{eq} at the exterior use areas of noise-sensitive receivers, which would not exceed 5 dBA above ambient noise levels. Impacts would be **less than significant**.

With implementation of Mitigation Measure **MM N-3**, measures to reduce loading dock noise such as barriers or site design to shield noise-sensitive receivers (verified by an acoustical professional on the project-level) would ensure that noise levels do not exceed 5 dBA over ambient at noise-sensitive receivers. Impacts would be **less than significant**.

With implementation of Mitigation Measure **MM N-4**, measures to reduce the relocated Corporation Yard noise such as barriers or site design to shield noise-sensitive receivers (verified by an acoustical professional on the project-level) would ensure that noise levels do not exceed 5 dBA over ambient at noise-sensitive receivers. Impacts would be **less than significant**.

Impact N-2 GENERATE EXCESSIVE GROUNDBORNE VIBRATION OR GROUNDBORNE NOISE LEVELS.

VIBRATION FROM THE PROPOSED 2021 LRDP CONSTRUCTION MAY EXCEED APPLICABLE STANDARDS. THIS IS A POTENTIALLY SIGNIFICANT IMPACT THAT WOULD BE REDUCED TO LESS THAN SIGNIFICANT WITH MITIGATION.

Construction

The greatest anticipated source of vibration during build-out of the proposed 2021 LRDP would derive from a vibratory roller, which may be used during paving activities but would likely not be needed for some anticipated construction projects. The second greatest source of anticipated vibration would be from a large bulldozer. A large bulldozer is used in this analysis to conservatively represent all other heavy-duty construction equipment (other than a vibratory roller).

Vibration-sensitive receivers would include humans, residential structures, campus laboratories, and historical buildings on campus (see Section 4.5, *Cultural Resources*). The distances at which these pieces of equipment would reach or exceed the applicable vibration thresholds are shown in Table 4.11-13.

Table 4.11-13 Screening Distances for Vibration-Sensitive Receiver Type and Source

Receiver Type	Vibration Threshold (in./sec. PPV)	Distance from Vibration Source (feet)[1]	
		Vibratory Roller	Large Bulldozer[2]
Distinctly Perceptible Human Annoyance	0.24	25	15
Historic Sites	0.1	40	25
Residential Buildings	0.4	20	10
Laboratory[3]	0.032	90	50

[1] These distances are based upon typical vibration levels for a vibratory roller and large bulldozer of approximately 0.210 in./sec. PPV and 0.089 in./sec. PPV at 25 feet, respectively (FTA 2018).

[2] A large bulldozer conservatively represents all heavy-duty construction equipment, other than a vibratory roller.

[3] The FTA lists a "Residential Day" ISO use, which is vibration that is barely felt and adequate for low-power optical microscopes, as having a vibration criteria of 78 vibration decibels (equivalent to 0.032 in./sec. PPV). For the purposes of analysis, a "Residential Day" ISO use is considered representative of laboratory settings on campus.

in./sec. = inches per second; PPV = peak particle velocity

With typical setbacks from the construction equipment and setbacks to buildings on nearby properties, a piece of equipment would not be anticipated to be within 25 feet of a receiver. Therefore, vibration impacts within 25 feet or closer are assumed to not occur, and significant vibration impacts would not occur to human annoyance and residential buildings. However, vibratory rollers have the potential to operate within 40 feet of a historical site (see Section 4.5, *Cultural Resources*, for a list of potential historical resources), and vibration impacts are considered significant. In addition, a vibratory roller or bulldozer have the potential to operate within 90 feet and 50 feet of a laboratory use, respectively, and vibration impacts are considered **significant**.

Operation

Implementation of the proposed 2021 LRDP would not involve substantial vibration sources associated with operation. Operational vibration impacts would be **less than significant**.

Mitigation Measures

MM N-5 Construction Vibration Reduction Measures

If construction equipment were to be operated within the specified distances listed in Table 4.11-13 of the Draft EIR, the campus shall reduce construction vibration levels through the following noise control measures:

- All academic and residential facilities within the listed distances shall be notified if the listed equipment is to be used during construction activities so that the occupants and/or researchers can take necessary precautionary measures to avoid negative effects to their activities and/or research.
- In addition, one of the following measures shall be implemented:
  - Use of the equipment shall not occur within the specified distances in Table 4.11-13 or
  - A project-specific vibration impact analysis shall be conducted that shall consider the type of equipment used and potential vibration levels at structures within the specified distances. If, after consideration of the type of equipment used and other factors of the environment, vibration levels do not exceed the applicable criteria, construction may proceed without additional measures. If, after consideration of the type of equipment used and other factors of the environment, vibration levels exceed the applicable criteria, additional measures shall be implemented to reduce vibration levels below threshold, if feasible. These measures may include, but not limited to, use of different equipment that results in an acceptable vibration level as listed in Table 4.11-13.

Significance After Mitigation

Through the project-specific vibration impact analysis and/or restrictions on vibration-generating construction equipment, impacts associated with vibration from construction activities would be **less than significant** with implementation of Mitigation Measure **MM N-5**.

Impact N-3 EXPOSURE TO PEOPLE RESIDING OR WORKING IN THE PROJECT AREA TO EXCESSIVE NOISE LEVELS FOR A PROJECT LOCATED WITHIN THE VICINITY OF A PRIVATE AIRSTRIP OR AN AIRPORT LAND USE PLAN OR, WHERE SUCH A PLAN HAS NOT BEEN ADOPTED, WITHIN 2 MILES OF A PUBLIC AIRPORT OR PUBLIC USE AIRPORT.

IMPLEMENTATION OF THE PROPOSED 2021 LRDP WOULD NOT EXPOSE PEOPLE RESIDING OR WORKING IN UCR TO EXCESSIVE NOISE LEVELS FROM AIRPORTS WITHIN TWO MILES OF THE CAMPUS AND NOISE IMPACTS WOULD BE LESS THAN SIGNIFICANT.

The Initial Study for the proposed 2021 LRDP noted that Flabob Airport is approximately 4.7 miles west of the UCR main campus, and March Air Reserve Base is approximately 6 miles southeast of the UCR main campus. As discussed in Section 4.9, *Hazards and Hazardous Materials*, UCR is in Area E of the (March ARB/IPA ALUCP) influence area. The ALUCP categorizes the noise level in Area E as “low” because Area E is beyond the 55-CNEL corridor, where only occasional overflights occur that would be “intrusive to some outdoor activities.” (Riverside County ALUC 2014).

Under existing case law “CEQA generally does not require an analysis of how existing environmental conditions will impact a project's future users or residents.” (*California Bldg. Industry Assn. v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369, 386.) The proposed 2021 LRDP would not exacerbate flights patterns and their associated noise. Furthermore, new development on campus would comply with Title 24 building standards, including noise insulation requirements (CBC Section 1207), which would ensure that new residents and students would not be adversely affected by existing noise sources. Exterior areas of campus would be exposed to aircraft noise levels that are lower than 55 CNEL, which is well below typical noise compatibility standards for residential or school uses (e.g., the City of Riverside General Plan Noise Element identifies noise levels of 60 CNEL or below as normally acceptable (City of Riverside 2018)). Additionally, ALUCP Zone "E" contains no limitations on indoor or outdoor uses. (ALUCP, Table MA-2).

Therefore, implementation of the proposed 2021 LRDP would not expose people residing or working in UCR to excessive noise levels from airports within two miles of the campus and noise impacts are determined to be **less than significant.**

Mitigation Measures

No mitigation is required.

Significance After Mitigation

Impacts would be less than significant without mitigation.

4.11.4 Cumulative Impacts

Construction-related noise and vibration are typically considered localized impacts, affecting only receivers closest to construction activities. Nevertheless, cumulative projects, including those proposed under the 2021 LRDP or those occurring off campus as identified in Table 4-1, occur in close proximity to each other (i.e., several hundred feet), and simultaneously, noise and vibration from individual construction projects and individual project components have a small chance of combining to create significant cumulative impacts. As discussed under Impact N-1, the project's contribution to cumulative noise from construction work is considered cumulatively considerable. As also discussed under Impact N-2, the project's contribution to cumulative vibration impacts from construction work is considered cumulatively considerable. As identified above, Mitigation Measure **MM N-1** would be implemented to reduce the project's cumulatively considerable contribution from general construction noise on campus to the extent feasible, however construction noise Impact N-1 would remain **cumulatively considerable with mitigation**. Mitigation Measure **MM N-5** would be implemented to reduce potentially significant impacts from construction vibration (Impact N-2) to **less than significant, and therefore would not be cumulatively considerable with mitigation**.

As discussed under Impact N-1, future traffic noise was analyzed in a cumulative, future scenario (Cumulative Plus Project), and traffic noise increases would not exceed the impact criteria. Even though traffic in the vicinity of the campus would gradually increase over the course of development of the proposed 2021 LRDP, the contribution of traffic noise impacts would not be cumulatively considerable. New development associated with cumulative projects (see Table 4-1), would include noise associated with parking facilities, mechanical equipment (HVAC units), loading docks, and the relocated Corporation Yard. As outlined in greater detail under Impact N-1, the proposed 2021 LRDP's contribution to cumulative impact N-1 is considered **cumulatively considerable**.

For campus projects, Mitigation Measures **MM N-2 through MM N-4** require HVAC equipment, loading dock, and the relocated Corporation Yard noise to be designed and located in such a way that noise is minimized at the nearest noise-sensitive receivers. Implementation of the proposed 2021 LRDP would not involve substantial vibration sources associated with operation, and the types of surrounding land uses (residential and commercial) to campus would not be expected to involve substantial vibration sources that would cumulatively combine with UCR vibration sources. With implementation of Mitigation Measures **MM N-2 through MM N-4,** potentially significant impacts from operational noise would be **less than significant, and therefore would not be cumulatively considerable with mitigation**.

As implementation of the LRDP would occur from 2021 to 2035, it is likely that there would be some overlap in noise impacts from construction. Although it would be speculative to analyze this impact due to the lack of available details on construction scheduling to estimate timing, location, and combined noise levels of such overlapping details in greater detail, there is the potential for construction noise levels from the project and from other projects to result in a cumulatively considerable noise impact. Therefore, **cumulative noise impacts are significant**.

No new airports or expansion of airports are included in the cumulative project list. The proposed 2021 LRDP does not include a new airport of expansion of an airport. Therefore, cumulative noise impacts from airports (Impact N-3) are **less than significant (not cumulatively considerable)**.

4.11.5 References

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